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# CAIRN Policy Brief

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## Competitive Pressure and Technology Adoption: Evidence from a Policy Reform in Western Canada

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### The Issue

In 1995 the Canadian Government abolished an export subsidy on railway shipments of grain from the Canadian Prairies known as the Western Grain Transportation Act (WGTA). This decision marked the end of one of the longest-running agricultural subsidies in the world, first known as the Crow's Nest Pass Agreement of 1897<sup>3</sup> and commonly referred to as the "Crow Rate." The removal of this transportation subsidy increased the cost of exporting grain from the prairie region of Canada by \$17-\$34/tonne, equivalent to 8%-17% of its value<sup>4</sup>. These increased transportation costs translated into lower grain prices at the farm-gate.

The repeal of the WGTA is often associated with a range of adaptations by farmers to the lower prices for export grains (see, for example, Doan et al. 2003, 2006). It is believed that some farmers adapted to the new environment by shifting to high-value export crops, feed grain production and animal production or by pursuing economies of size in grain production.

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<sup>3</sup> See Vercammen (1996) for a detailed overview of reforms to the western grain transportation system.

<sup>4</sup> This assumes an average grain price of \$200/tonne.

Innovations may also have included a change in input mixes, new marketing channels and the use of new technologies. Ultimately, some farmers found they could no longer be competitive and sold their farms, allowing farm size expansion by others.

The 1990's also marked the beginning of large-scale adoption of a new seeding technology called "zero tillage" in Western Canada<sup>5</sup>. The innovation was a seeding method that could prepare the seedbed and deposit the seed all in one operation while disturbing the soil as little as possible. The conventional seeding method was to first cultivate the soil, then seed, which disturbed the soil and led to erosion problems under windy conditions. The benefits of zero tillage were to reduce fuel use, conserve soil moisture, decrease soil erosion and reduce labor requirements. Zero tillage has become the dominant seeding technology on the prairies, increasing from 8% to 49% of cultivated acres between 1991 and 2006.

In our study, we examined whether the increased competitive pressure stemming from the removal of the WGTA transportation subsidy led to increased adoption of zero tillage technology by farmers. We also examine the impact of the WGTA repeal on fertilizer use, the practice of summerfallow, and production of crops and livestock.

It is challenging to isolate the impact of the repeal of the Crow Rate because the 1990's were a dynamic time for prairie agriculture for several reasons, not just because of the repeal of the WGTA. Improvements in farm equipment led to larger and more efficient farms, and breeding techniques for high-value crops led to their increasing popularity. Many farmers were approaching retirement age and often sold or rented their land to other farmers who were seeking size economies.

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<sup>5</sup>Zero tillage, also referred to as "no-till," has been adopted rapidly in several countries, with equipment often tailored to local conditions and crops. Worldwide acreage in no-till increased from 111 to 274 million acres between 1999 and 2009, and predominates in the United States, Brazil, Argentina, Canada and Australia (Derpsch et al. 2010).

World prices for agricultural commodities also varied widely from 1995 onward, which surely affected farmers' production and technology adoption decisions. We thus need to utilize an empirical strategy that allows us to determine whether the subsequent prairie agriculture structural changes were attributable to the end of the WGTA or if farmers would have adopted new technologies, adapted their production, or been weeded out by increasing competition even without the repeal of the WGTA. To the best of our knowledge such an empirical investigation has never been undertaken.

## Main Results

We utilize extensive Census and independent freight rate data for approximately 400 finely detailed spatial units across the Canadian provinces of Alberta, Saskatchewan and Manitoba in our analysis. We are able to show, using a difference-in-differences methodology, that the impact of the WGTA repeal on technology adoption and production varied significantly across the prairies. It is important to note that our results here measure the differential impact of higher freight rates across locations, not the average change before vs. after the reform. The geographic areas/locations are differentiated by the variation in the freight rate increase they experienced, which in turn reflected their distance from the export position.

We find that a one dollar per tonne greater increase in the freight rate in a CCS led to an increase in zero tillage adoption by 0.97 percentage points, an increase in fertilizer adoption by 1.29 percentage points and a reduction in summerfallow by 0.96 percentage points. The results are consistent with the common pattern that zero tillage is associated with a reduction in summerfallow and an increase in fertilizer usage. The interpretation is that the lower grain prices (resulting from higher freight rates) encouraged farmers to modernize their production methods in an effort to remain competitive.

The effects of higher freight rates on zero tillage adoption are large. For example, comparing two locations that experienced a \$20/tonne vs. \$30/tonne freight rate increase, our results indicate that zero tillage adoption will be  $\$10/\text{tonne} \times 0.97 = 9.7$  percentage points higher in the more severely affected location. Compared with the average increase in zero tillage adoption of 23 percent between 1991 and 2001, the impact of transportation costs is economically significant.

We find that the increase in freight rates led to a statistically significant decrease in wheat acreage with every additional dollar increase in transportation costs leading to a 0.75 percentage point decrease in wheat acreage. In contrast, we find a weak positive effect of higher freight rates on the share of acres in canola. We do not find any effect on the share of acres in pasture or on cattle production. The lack of a strong impact on canola acreage may stem from the fact that there was only a 2.5 percentage point average increase in canola acreage over the 1991-2001 across the Prairies. The non-significant result for cattle production is likely due to the fact that cattle production has been concentrated in Alberta, where freight rates did not increase as much as in Saskatchewan or Manitoba. We find an unexpected negative and significant effect of freight rates on hog production. The number of cattle and hogs increased in all locations on average after 1991, and some of this may be attributable to the policy reform. Moreover, the offsetting subsidies for animal feed may have encouraged livestock production prior to the WGTA repeal.

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